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The Mortality Trend in the Industrial Population*

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IN THIS paper is presented a summary of a report just completed on the mortality experience among $3\frac{1}{4}$ million white male wage earners insured in the Industrial Department of the Metropolitan Life Insurance Company. The study covered the 3-year period 1922 to 1924 inclusive, and is an exact parallel of one covering the 3-year period 1911 to 1913. Taken in conjunction with this earlier work, our present investigation makes available a picture of mortality probably unsurpassed in detail among American wage earners during the years when the movement for better industrial hygiene was being widely extended. It should be kept in mind that the industrial policy holders who formed the basis of the study consist of people in the United States and Canada who earn their livelihood in our manufacturing plants, mines, transportation industries and other mechanical pursuits. They constitute a fairly homogeneous social and economic group which may be described as the urban wage earning population.

The adult males of this class have a higher mortality and diminished longevity than those in other forms of employment. As is shown in Table I, the mortality rate for the group of insured males is higher than that of all males living in the U. S. Registration States in every age period from 25 to 64 years.

Curiously enough, the mortality rate of the insured group, at all ages combined, is lower than that of males in the registration states, being 11.8 and 13.8 per 1,000 respectively. This is due to lower mortality in the first age group—15 to 24 years—and in the last—65

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TABLE I
DEATH RATES PER 100,000 FOR ALL CAUSES OF DEATH
AGES 15 YEARS AND OVER
White Males
1923

| Years of Age | 15 and over | 15 to 24 | 25 to 34 | 35 to 44 | 45 to 54 | 55 to 64 | 65 and over |
|---|----------------|-------------|-------------|-------------|-------------|-------------|----------------|
| United States Registration States | 1,384.5 | 363.8 | 457.7 | 717.4 | 1,207.4 | 2,527.8 | 8,304.6 |
| Metropolitan Industrial Dept. | 1,183.5 | 347.2 | 556.1 | 946.6 | 1,725.4 | 3,385.3 | 7,574.7 |
| Per Cent Insured of Population Death Rates | 85.5 | 95.4 | 121.5 | 131.9 | 142.9 | 133.9 | 91.2 |

years and over. At age 25, the mortality rate of the insured is already higher and remains so up to age 64, increasing progressively from age 25 to 54 years. In the age period 45 to 54 years, the death rate for the insured exceeds that for the general population group by 43 per cent. In the succeeding age period—55 to 64 years—the rate is 34 per cent higher. These rates reflect the results of industrial exposure. In the beginning, the group of policy holders is in its best physical condition and has a lower mortality rate than the general population. At age 25, the situation changes; and thereafter, largely we believe as a result of industrial hazards, the mortality rate is heavier than that of the general male population. The last age period, where the insured again make a more favorable showing, is not reliable because most of our industrial policies terminate at age 74. It therefore follows that the average age of policy holders in the class 65 years of age and over is lower than that of the corresponding population group; and consequently, other things being equal, one would expect their mortality rate to be lower.

The effects of industry are also clearly revealed in the differential death rates for males and females of the same economic class. Comparing the death rates given in Table II for male policy holders and for their wives and sisters as represented by our female industrial policy holders, we find some striking differences. After age 10, the mortality rates for males are consistently higher than for females, with the single exception of the age period 15 to 24 years. Since the industrialization of women is then at its height, the question of the

TABLE II
DEATH RATES PER 100,000 FOR ALL CAUSES OF DEATH
AGES 10 YEARS AND OVER
METROPOLITAN LIFE INSURANCE COMPANY
INDUSTRIAL DEPARTMENT
1923

| Years of Age | 10 to 14 | 15 to 24 | 25 to 34 | 35 to 44 | 45 to 54 | 55 to 64 | 65 and over |
|-------------------------|-------------|-------------|-------------|-------------|-------------|-------------|----------------|
| White Males | 198.6 | 347.2 | 556.1 | 946.6 | 1,725.4 | 3,385.3 | 7,574.7 |
| White Females | 162.4 | 353.3 | 491.9 | 677.9 | 1,188.0 | 2,576.1 | 6,726.7 |
| Per Cent Male of Female | 122.3 | 98.3 | 113.1 | 139.6 | 145.2 | 131.4 | 112.6 |

relative susceptibility of men and of women to the exactions of industry upon their health is definitely raised. After this age, the large majority of these women become housewives, and we notice a much lower rate of mortality for them in each succeeding age period than for men. This, we think, is largely traceable to the absence of industrial hazards in the life of most women.

Even more marked differences suggestive of the effects of industrial exposures are found when the mortality of industrial males is compared with that of persons who are for the most part engaged in non-hazardous pursuits. We may take, for this comparison, white male policy holders insured in the ordinary department of the Metropolitan Life Insurance Company, composed mainly of the clerical, professional, and commercial classes. Agricultural workers and the better paid mechanics are also represented in fairly large numbers. Age for age considered, the mortality rates for the industrial group run from one and one-half times to more than double the rates for those in the ordinary department. This is shown in Table III.

TABLE III

DEATH RATES PER 100,000 BY SPECIFIED AGE GROUPS FOR ALL CAUSES OF DEATH, 1923
REGULAR ORDINARY DEPARTMENT PREMIUM-PAYING BUSINESS (TOTAL MALES)
COMPARED WITH INDUSTRIAL DEPARTMENT PREMIUM-PAYING BUSINESS (WHITE MALES)

| Years of Age | 20 and over | 20 to 24 | 25 to 34 | 35 to 44 | 45 to 54 | 55 to 64 | 65 and over |
|---------------------------------|----------------|-------------|-------------|-------------|-------------|-------------|----------------|
| Industrial Males | 1,404.1 | 400.6 | 556.1 | 946.6 | 1,725.4 | 3,385.3 | 7,574.7 |
| Ordinary Males | 550.0 | 255.2 | 268.4 | 422.0 | 790.1 | 1,868.0 | 5,604.1 |
| Per Cent Industrial of Ordinary | 255.3 | 157.0 | 207.2 | 224.3 | 218.4 | 181.2 | 135.2 |

In terms of life expectation, the severer status of the industrial worker is equally impressive. The industrial worker at age 20, when he begins his career, has an expectation of life of 42 years; or in other words he may expect to reach 62. The 20-year old worker engaged in non-hazardous occupations, however, may expect to attain age 69, or 7 years additional. Industrial workers are at a disadvantage in each succeeding period; at age 30 the difference is 6.6 years, at age 50, 4.2 years, and at age 70, 1.3 years, always in favor of the non-industrial group.

The above comparisons between the death rates of various groups—males insured in the industrial department of the Metropolitan, males of the registration states, males insured in the ordinary branch of the Metropolitan, and females of the wage earning class—show clearly the influence of industrial environment on mortality rates and life expectation. The difference in the mortality rates for these groups gives a rough measure of the tax which industrial work exacts,

and reflects the hazards to which workers are exposed. Other items obviously account for a part of the disparity in these figures. Heredity and innate differences play some part, but probably the most important factors are the conditions incidental to industrial employment including deleterious dusts, excessive fatigue, bad posture, crowded work rooms, dampness, extreme changes of temperature and sometimes specific occupational poisoning, to which industrial workers are so frequently exposed.

The health picture of the industrial worker is, however, far from discouraging when we consider the vast improvement which has taken place in recent years. Between 1912 and 1923 the death rate for our industrial group has declined from 1,621.7 per 100,000 to 1,183.5 per 100,000. Not only has there been a total decline of 27 per cent, but a substantial decline in the death rate has characterized every age group. On account of this reduced mortality, almost 14,000 fewer deaths have occurred among the $3\frac{1}{4}$ million policy holders in the single year of 1923 than would have taken place had the mortality rates of 1912 prevailed. This amounts in terms of life expectation to an average increase of 5 years for each industrial worker at age 20; and there has been some increase in longevity at every age period. The greatest reduction in mortality has taken place in the important working ages 25 to 34 and 35 to 44, when the rates declined 43.1 and 41.2 per cent respectively. Less progress is recorded after age 55, the decline amounting to only 16.4 per cent in the age period 55 to 64 years.

Turning now to a consideration of the specific diseases causing mortality among our working population, we find that almost every cause of death has shared in the highly gratifying downward trend of mortality.

Tuberculosis of the respiratory system, which in 1912 was the chief cause of death, has shown a very great improvement, the death rate declining from 319.9 per 100,000 in 1912 to 149.7 in 1923, a fall of 53.2 per cent. As a result, tuberculosis is now superseded by heart disease as the leading cause of death. Workers 25 to 34 years of age and 35 to 44 years were the most favorably affected, the decreases amounting to 60.2 and 62.6 per cent respectively. Nephritis has shown a significant though a smaller decrease of 38.0 per cent, the rates declining from 178.1 for all ages in 1912 to 110.5 in 1923. The mortality rate of this disease showed the greatest decline in the 35 to 44 age period where it went down 55.7 per cent. Mortality from pneumonia also showed a substantial reduction of 26 per cent, the rate in 1923 being only 92.5 per 100,000. The younger workers en-

joyed the greatest decline, the reduction amounting to 42.4 and 35.2 per cent respectively in the age periods 25 to 34 and 35 to 44. The fatal accident rate was reduced from 140.6 in 1912 to 121.2 in 1923, a decline of 13.8 per cent. Organic diseases of the heart showed little change at all ages. The death rate declined 7.5 per cent, or from 203.9 per 100,000 to 188.7. In the age period 35 to 44, however, the reduction amounted to 33.5 per cent.

Some of the lesser causes of death display a marked diminution, notably typhoid fever, cirrhosis of the liver and suicide, with decreases of 72.2, 65.4 and 42.2 per cent respectively. The effects of better industrial hygiene are clearly seen in the 50 per cent decline in the death rate from chronic lead poisoning, a disease almost exclusively occupational in origin.

Several exceptions to the general downward trend of mortality are to be noted. Cancer has increased in frequency, the death rate rising from 77.6 per 100,000 in 1912 to 94.9 in 1923, a rise of 22.3 per cent. In the important age periods 45 to 54 and 55 to 64, the rates increased 15.5 per cent and 30.6 per cent respectively. Influenza went up 157 per cent and automobile accidents almost 500 per cent at all ages. Diabetes and homicides registered increases, 13 and 18 per cent respectively for all ages. Cancer, influenza and automobile accidents increased at every age period; diabetes at every period after age 45; and homicides at every period except the 45 to 54 and 55 to 64.

TABLE IV

PER CENT DECLINE IN DEATH RATES AMONG WHITE MALES AND WHITE FEMALES INSURED IN INDUSTRIAL DEPARTMENT AND AMONG WHITE MALES OF THE REGISTRATION STATES OF 1910

| Age Group Years | Metropolitan Life Insurance Company 1912 to 1923 | | Registration States 1911 to 1923 |
|--------------------|---|---------------------------|-------------------------------------|
| | White Males Per Cent | White Females Per Cent | White Males Per Cent |
| 15 and older | 27.0 | 21.1 | 3.5 |
| 15-24 | 26.0 | 21.1 | 19.3 |
| 25-34 | 43.1 | 27.5 | 29.0 |
| 35-44 | 41.2 | 28.2 | 23.2 |
| 45-54 | 26.3 | 17.5 | 15.7 |
| 55-64 | 16.4 | 13.7 | 6.1 |
| 65 years and older | 13.4 | 12.1 | + 3.6 |

Those who are concerned with the health of the working population will be especially interested to observe that the death rate at every age has declined more rapidly for the industrial group than for others.

Table IV shows the percentage of decline in mortality of white males insured in our industrial department as compared with insured

white females and white males of the general population (U. S. Registration States of 1910).

Age for age considered, the decline in the death rates for our insured group has been from 7 to 18 per cent greater than the decline for males of the registration states; and from 1 to 16 per cent greater than for females of the industrial population. The greatest gain for all classes has been at the ages 25 to 34 and 35 to 44 years; and at these ages also the rate of decline for industrial males exceeds by the greatest margin the decline in the rates of the other classes. It would be very instructive if we could make similar comparisons between the trend in the death rates for individual causes of death for males of the registration states and for males insured in our industrial department. Unfortunately, the data necessary are not available. However, our figures, although incomplete, indicate that the decline in mortality among industrial males has been more rapid for all of the more important causes of death. This fact has been conclusively shown for tuberculosis in a recent study¹ on the declining tuberculosis death rate where it is pointed out that the maximum decline in the death rate from tuberculosis among industrial males between the years 1911 and 1925 occurred at the ages between 20 and 45 years and that at these ages the rate of decline was about 20 per cent greater among industrial males than among males in the general population.

It would be of the utmost value to our discussion if it were possible to present the facts for the trend of mortality among men engaged in specific occupations. We should then be able to learn whether all occupations were sharing in the improved conditions; what preventive measures had been productive of the greatest good; and where there was the greatest need for intensive future efforts. Incredible though it may seem, the number of occupations for which we have death rates covering a period of years in the United States is very small and the data do not lend themselves to ready interpretation. We did not have for our study the number of insured in each occupation; and for that reason, we cannot present death rates by occupation. We were, therefore, compelled to use the method of proportionate mortality, that is, to find out for each occupation the part that any cause of death played in the total mortality with due regard to age. While not as sensitive a measure as actual death rates, this method affords a fairly reliable indication of what the actual death rates for each cause would show. It is not feasible to present here the many instructive findings of this analysis. The facts for tuberculosis, however, are outstanding and are of especial interest to industrial hygienists.

Seventy-two occupational classes were investigated. Of these, all but 6 showed a lower percentage of deaths from tuberculosis in the period 1922 to 1924 than in 1911 to 1913. The occupations with the highest proportion of deaths from this cause were, in order: miners, underground—other than coal miners; pottery workers; stone cutters; waiters and hotel servants; cutlers and grinders; cigar makers and tobacco workers; laundry workers; compositors, printers, and pressmen; brass foundry workers; barbers and hair dressers; glass workers; and the clerical workers. There has been a decline in the percentage of deaths from tuberculosis for each of these occupations, except the miners (other than coal miners), since 1911–1913. Data are not available for individual groups of metal miners, such as gold and silver, lead and zinc, iron, etc.; but as a group, metal miners have shown, in more recent years, a higher ratio of deaths from tuberculosis than they did a decade or more ago. The increase is so slight that it is entirely possible that the actual tuberculosis death rate has decreased in this group, also. The apparent higher proportion of deaths from tuberculosis among miners may well be the result of greater reductions for the other major causes of death.

What factors have brought about this vast improvement in the health and longevity of industrial workers? Surely among the many causes must be included the wide expansion of workmen's compensation, preventive industrial medicine, the safety movement, the reduction in the hours of labor, elimination of the sweat-shop, better plant sanitation, the wider education of the workers regarding the dangers inherent in certain occupations, and the more intelligent care now taken to safeguard the health of workers, as contributory to this gratifying result. But even more important has been the improved standard of living which the increased prosperity of the American wage earner has provided. The outlook for the future is bright indeed. There is every reason to believe that the continuation and expansion of health activities in industry, noticeable everywhere, will result in further reductions in mortality. The trend in the death rate according to our recent figures is still downward. It is not unreasonable to expect, therefore, that in the not far distant future the mortality rates of industrial workers will approach, if they do not quite equal, those of the more favored classes of the population.

REFERENCE

1. Dublin and Van Buren. Special Aspects of the Declining Tuberculosis Death Rate in the United States, *Tubercle*, 9: 22–31 (Oct.), 1927.